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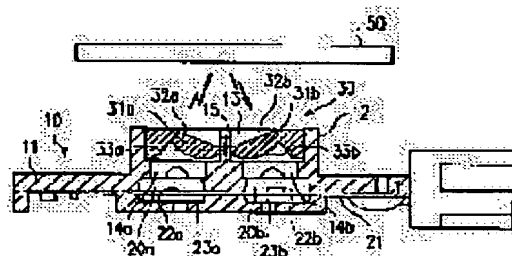
(54) REFLECTING OPTICAL COUPLER

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a reflecting optical coupler with converging lenses capable of ensuring easy cleaning on the front face of a cover.

SOLUTION: A light emitting element 20a and a light receiving element 20b are sealed in a body 10 formed of a shading resin. A cover 30 is fitted into the body 10 to be located on the front faces of the light emitting element 20a and the light receiving element 20b.

Converging lenses 31a, are formed on the cover 30 corresponding to the light emitting element 20a and the light receiving element 20b. The converging lenses 31a, 31b are formed as convex lenses which have flat surfaces 32a, 32b on the front face sides and spherically protruded surfaces 33a, 33b on the element sides.



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CLAIMS

[Claim(s)]

[Claim 1] Have the light emitting device and photo detector by which the parallel arrangement was carried out on both sides of the protection-from-light member, and it irradiates from this light emitting device. In the reflective mold optical coupling equipment which detects the existence of this detected body by receiving the reflected light reflected by the detected body by this photo detector Reflective mold optical coupling equipment which it has covering which is from a translucency ingredient on the front-face side of this light emitting device and this photo detector, and the front-face side of this covering is a flat surface, and prepared the lens for condensing in the part which counters this light emitting device and this photo detector by the side of the rear face of this covering.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention is equipped with the light emitting device and photo detector by which the parallel arrangement was carried out, and relates to the reflective mold optical coupling equipment with a condenser lens which restricted the detection range with the condenser lens in more detail about the reflective mold optical coupling equipment which detects a body by receiving the reflected light when the light irradiated from the light emitting device is reflected by the body (detected body) by the photo detector.

[0002]

[Description of the Prior Art] As a photosensor of a reflective mold, there is reflective mold optical coupling equipment called a reflection photo interrupter. This reflective mold optical coupling equipment is used as a noncontact sensor which detects the various bodies which are the detected body in the state of non-contact, and the reflective mold optical coupling equipment with a condenser lens which restricted the detection range with the condenser lens also in it is mainly used for detection of the form in form conveyance systems, such as a copying machine and a printer.

[0003] An example of conventional reflective mold optical coupling equipment equipped with the condenser lens is shown in drawing 4 , and the structure of the condenser lens used for the reflective mold coupler is shown in drawing 5 and drawing 6 . Moreover, the example of an activity of the reflective mold coupler is shown in drawing 7 .

[0004] The reflective mold optical coupling equipment shown in drawing 4 is equipped with the covering 40 by which was located in the front-face side (drawing on) of the body 10 which consists of protection-from-light nature resin, light emitting device 20a and photo detector 20b which were enclosed in the body 10, and light emitting device 20a and photo detector 20b, and fitting was carried out into the body 10.

[0005] Light emitting device 20a and photo detector 20b mount light emitting diode and a photodiode on the frame 21 shared between each, and have structure which enclosed these, respectively into resin object 23a which consists of translucency resin, and 23b.

[0006] Covering 40 is formed by translucency resin. It is located in the front-face side of each of light emitting device 20a and photo detector 20b, and the condenser lens sections 41a and 41b are formed in this covering 40, respectively. As shown in drawing 5 and drawing 6 , the condenser lens sections 41a and 41b are the convex lenses with which the front faces 42a and 42b by the side of each front face projected in the front-face side, and incline in the direction in which each optical axis crosses by the front-face side.

[0007] And it is shaded by some bodies 10 which all consist of protection-from-light nature resin between condenser lens section 41a between resin object 23a by the side of light emitting device 20a, and resin object 23b by the side of photo detector 20b, and by the side of light emitting device 20a, and condenser lens section 41b by the side of photo detector 20b.

[0008] It is condensed by condenser lens section 41a of covering 40, and the light irradiated from light emitting device 20a is irradiated at a front-face side. Exposure light is reflected by the detected body 50 when the detected body 50 exists ahead [the / direction-of-radiation]. It is

condensed by condenser lens section 41b of covering 40, incidence of the reflected light is carried out to photo detector 20b, and photo electric translation is carried out by photo detector 20b, and it is outputted. And non-contact detection of the existence of the detected body 50 is optically carried out by this output electrical signal.

[0009] Thus, each flux of light of exposure light and the reflected light is extracted with a condenser lens, and the reflective mold optical coupling equipment which restricted the detection range is mainly used for detection of the form in form conveyance systems, such as a copying machine and a printer, as it was mentioned above.

[0010] Drawing 7 shows an example of this form detection system. In this form detection system, in the inside of the clearance 80 (usually 2-4mm) formed among the level guide plates 60 and 70 by which opposite arrangement was carried out, in case the form as the detected body 50 is conveyed, that form is detected by the above-mentioned reflective mold optical coupling equipment with a condenser lens arranged under the guide plates 60 and 70. For this form detection, it extracts, and holes 61 and 71 are located in the front-face side of reflective mold optical coupling equipment, and are prepared in guide plates 60 and 70.

[0011] If it extracts and the path of holes 61 and 71 is large at this time, a form will become easy to be caught in these holes, and it will become the cause of a paper jam. For this reason, it extracts and the path of holes 61 and 71 is restricted to about 10mm.

[0012] Under such a situation, if each flux of light of the exposure light in reflective mold optical coupling equipment and the reflected light is large, guide plates 60 and 70 will extract, light will be equivalent to the part around holes 61 and 71, and the unnecessary reflected light will be detected. Consequently, lowering of the S/N ratio obtained by the existence of a form arises, when the worst, also in the condition that a form does not exist, it will extract and a form will be accidentally detected by the reflected light from the perimeter of holes 61 and 71.

[0013] For this reason, each flux of light of exposure light and the reflected light is extracted to detection of the form in form conveyance systems, such as a copying machine and a printer, with a condenser lens, and the reflective mold optical coupling equipment with the condenser lens section which restricted the detection range is used for it.

[0014]

[Problem(s) to be Solved by the Invention] However, there are the following problems in reflective mold optical coupling equipment with the conventional condenser lens.

[0015] Although it is a minute amount whenever a form passes through the clearance 80 formed among guide plates 60 and 70, if it is in a form detection system as shown in drawing 7, the guide plate 60 of the lower berth extracts and paper powder falls from a hole 61. This paper powder is deposited on the covering 40 of the reflective mold optical coupling equipment arranged caudad, and closes the in-and-out path of light by covering the condenser lens sections 41a and 41b. For this reason, cleaning which wipes off the front face of covering 40 periodically by maintenance service etc. is performed.

[0016] Although this cleaning becomes easy and so positive that the front face by the side of the front face of covering 40 is flat a thing, since the condenser lens sections 41a and 41b formed in covering 40 are the convex lenses with which the front faces 42a and 42b by the side of each front face projected in the front-face side, in conventional reflective mold optical coupling equipment, there is much irregularity of the front face by the side of the front face of covering 40. For this reason, the workability of cleaning was bad and, moreover, there was a problem that the check of a cleaning condition was not easy.

[0017] This invention solves the above-mentioned conventional problem, and although the object is with a condenser lens, it is to offer the reflective mold optical coupling equipment which can ensure [easily and] cleaning of the lens section.

[0018]

[Means for Solving the Problem] The reflective mold optical coupling equipment of this invention is equipped with the light emitting device and photo detector by which the parallel arrangement was carried out on both sides of the protection-from-light member. In the reflective mold optical coupling equipment which detects the existence of this detected body by receiving the reflected light which it irradiates from this light emitting device, and is reflected by the detected body by

this photo detector The front-face side of this light emitting device and this photo detector was equipped with covering, the front-face side of this covering is a flat surface, and the lens for condensing is prepared in the part which counters this light emitting device and this photo detector by the side of the rear face of this covering, and the above-mentioned object is attained by that.

[0019] An operation of this invention is explained below.

[0020] In the reflective mold optical coupling equipment of this invention, since each condenser lens section formed in covering respectively corresponding to a light emitting device and a photo detector is formed in the condition of projecting in the rear-face side of covering, flattening of the front face by the side of the front face of covering is carried out, and the irregularity of the front face decreases. For this reason, that cleaning becomes easy when cleaning the front face by the side of the front face of covering. Moreover, the front face is legible and the check of a surface cleaning condition becomes easy. Maintenance nature improves by these.

[0021] In addition, about a condensing function, it is not different from the case where the front face by the side of the front face of each condenser lens section is made to project to a front-face side.

[0022]

[Embodiment of the Invention] The gestalt of operation of this invention is explained based on a drawing below.

[0023] Drawing 1 - drawing 3 show the operation gestalt of this invention reflective mold optical coupling equipment. The reflective mold optical coupling equipment of this operation gestalt is equipped with the body 10 which consists of protection-from-light nature resin, light emitting device 20a and photo detector 20b which were enclosed in the body 10, and the covering 30 by which was located in these front-faces side and fitting was carried out into the body 10 as shown in drawing 1.

[0024] As compared with the conventional reflective mold optical coupling equipment with which this reflective mold optical coupling equipment was shown in drawing 4 - drawing 6, covering 30 is different. Hereafter, the structure of each part is explained focusing on the part related to covering 30.

[0025] The body 10 which consists of protection-from-light nature resin has the plate-like base section 11 and the heights 12 which projected in the upper part from the center section. The square crevice 13 into which covering 30 fits is established in the top face of heights 12. In order to make the base of a crevice 13 open a crevice 13 for free passage optically with downward light emitting device 20a and photo detector 20b, Openings 14a and 14b are formed in it. Moreover, it is located among Openings 14a and 14b, and the projection 15 is formed.

[0026] Light emitting device 20a and photo detector 20b were enclosed in the center section of the base section 11 of the body 10, and the crevice 13 is faced them through Openings 14a and 14b, respectively. The structure of light emitting device 20a and photo detector 20b mounts a light emitting diode and a photodiode on the frame 21 shared between each, and has become what enclosed each chip, respectively into resin object 23a which consists of translucency resin, and 23b as it was mentioned above. The resin objects 23a and 23b are shaded with the formation ingredient (protection-from-light nature resin) of the body 10 with which it filled up between them.

[0027] Covering 30 is the plate-like one mold goods of the square which used translucency resin, and is inserted in the crevice 13 of covering 30 from the upside (front-face side). This covering 30 is located in the both sides of a slit 34, and has the condenser lens sections 31a and 31b while it has the slit 34 into which the projection 15 of the body 10 fits in the center section, as shown in drawing 2 and drawing 3.

[0028] The condenser lens sections 31a and 31b are located in the front-face side of each of light emitting device 20a and photo detector 20b, respectively, and incline in the direction in which each optical axis crosses by the front-face side. And condenser lens section 31a by the side of light emitting device 20a is the convex lens which surface 32a by the side of a front face was made [convex lens] into the flat surface, and made surface 3a by the side of a component project in the shape of the spherical surface to a component side. The front faces 32a and 33a

of condenser lens section 31a incline toward a slit 34 side with the dip of the optical axis mentioned above. Similarly, condenser lens section 31b by the side of light-receiving object 20b makes a flat surface surface 32b by the side of a transverse plane, it is the convex lens which made surface 33b by the side of a component project in the shape of the spherical surface to a component side, and the front faces 32b and 33b incline toward a slit 34 side with the dip of the optical axis mentioned above.

[0029] Moreover, the condenser lens sections 31a and 31b are shaded when the projection 15 of the body 10 fits into the slit 34 in the meantime.

[0030] Actuation of the reflective mold optical coupling equipment of such a configuration is explained.

[0031] It is condensed by condenser lens section 31a of covering 30, and the light irradiated from light emitting device 20a is irradiated at a front-face side. Exposure light is reflected by the detected body 50 when the detected body 50 exists ahead [the / direction-of-radiation]. It is condensed by condenser lens section 31b of covering 30, incidence of the reflected light is carried out to photo detector 20b, photo electric translation is carried out like the above-mentioned conventional example, and the existence of the detected body 50 is detected now in the state of non-contact.

[0032] This reflective mold optical coupling equipment is used for detection of the form which has the upper part conveyed in form conveyance systems, such as a copying machine and a printer, (refer to drawing 7). In that case, although it is a minute amount whenever the form which is the detected body 50 passes through the upper part of reflective mold optical coupling equipment, paper powder falls. The paper powder which fell is deposited on the covering 30 of the reflective mold optical coupling equipment arranged caudad, and closes the in-and-out path of light by covering the condenser lens sections 31a and 31b. For this reason, although cleaning which wipes off periodically the front face by the side of the transverse plane of covering 30 by maintenance service etc. is performed, the condenser lens sections 31a and 31b formed in covering 30 are the convex lenses which made the front faces 33a and 33b by the side of each component project to a component side, and since the front faces 32a and 32b by the side of that transverse plane are flat surfaces, there is little irregularity of the front face by the side of the transverse plane of covering 30. For this reason, that cleaning becomes easy when cleaning the front face by the side of the transverse plane of covering 30. Moreover, the front face is legible and the check of a surface cleaning condition becomes easy. Maintenance nature improves by these.

[0033]

[Effect of the Invention] Since each condenser lens section formed in covering respectively corresponding to a light emitting device and a photo detector is formed in the condition of projecting in the rear-face side of covering according to this invention reflective mold optical coupling equipment of a more than, flattening of the front face by the side of the front face of covering is carried out and the irregularity of the front face by the side of the front face of covering decreases, the cleaning becomes easy when cleaning the front face by the side of the front face of covering. Moreover, the front face is legible and the check of a surface cleaning condition becomes easy. Therefore, in spite of being with a condenser lens, the outstanding maintenance nature is secured.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The vertical section side elevation of this invention reflective mold optical coupling equipment.

[Drawing 2] The top view of covering of this invention reflective mold optical coupling equipment.

[Drawing 3] The vertical section side elevation of covering of this invention reflective mold optical coupling equipment.

[Drawing 4] The vertical section side elevation of conventional reflective mold optical coupling equipment.

[Drawing 5] The top view of covering of conventional reflective mold optical coupling equipment.

[Drawing 6] The vertical section side face of covering of conventional reflective mold optical coupling equipment.

[Drawing 7] The vertical section side elevation of the form detection system which used reflective mold optical coupling equipment.

[Description of Notations]

10 Body

20a Light emitting device

20b Photo detector

30 Covering

31a, 31b Condenser lens section

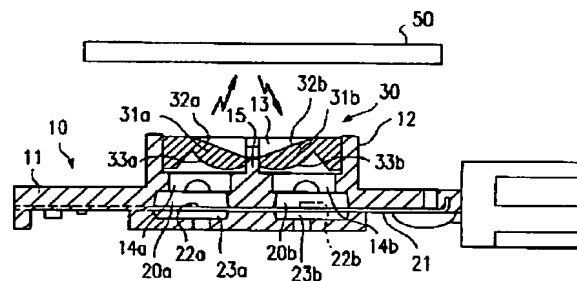
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C

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【特許請求の範囲】

【請求項1】 遮光部材を挟んで並列配置された発光素子と受光素子とを備え、該発光素子から照射され、被検出体によって反射される反射光を該受光素子によって受光することにより該被検出体の有無を検出する反射型光結合装置において、

該発光素子及び該受光素子の前面側に透光性材料からなるカバーを備え、該カバーの前面側が平面であり、且つ該カバーの後面側の該発光素子及び該受光素子に対向する部分に集光用レンズを設けた反射型光結合装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、並列配置された発光素子及び受光素子を備え、発光素子から照射された光が物体（被検出体）により反射されたときの反射光を受光素子により受光することにより物体の検出を行う反射型光結合装置に関し、より詳しくは集光レンズにより検出範囲を制限した集光レンズ付きの反射型光結合装置に関する。

【0002】

【従来の技術】反射型の光センサとして、反射型フォトインタラプタと称せられる反射型光結合装置がある。この反射型光結合装置は、被検出体である各種物体を非接触状態で検出する非接触センサとして使用されており、そのなかでも集光レンズにより検出範囲を制限した集光レンズ付きの反射型光結合装置は、複写機、プリンタ等の用紙搬送系における用紙の検出に主に使用されている。

【0003】集光レンズを備えた従来の反射型光結合装置の一例を図4に示し、その反射型結合装置に使用された集光レンズの構造を図5及び図6に示す。また、その反射型結合装置の使用例を図7に示す。

【0004】図4に示された反射型光結合装置は、遮光性樹脂からなるボディ10と、ボディ10内に封入された発光素子20a及び受光素子20bと、発光素子20a及び受光素子20bの前面側（図では上側）に位置してボディ10内に嵌合されたカバー40とを備えている。

【0005】発光素子20a及び受光素子20bは、それぞれの間で共用されるフレーム21の上に発光ダイオード及びフォトダイオードを実装し、これらを透光性樹脂からなる樹脂体23a及び23b中にそれぞれ封入した構造になっている。

【0006】カバー40は透光性樹脂で形成されている。このカバー40には、発光素子20a及び受光素子20bの各前面側に位置して、集光レンズ部41a及び41bがそれぞれ形成されている。集光レンズ部41a及び41bは、図5及び図6に示すように、それぞれの前面側の表面42a及び42bが前面側に突出した凸レンズであり、且つそれぞれの光軸が前面側で交差する方

向に傾斜している。

【0007】そして、発光素子20a側の樹脂体23aと受光素子20b側の樹脂体23bとの間、及び発光素子20a側の集光レンズ部41aと受光素子20b側の集光レンズ部41bとの間は、いずれも遮光性樹脂からなるボディ10の一部により遮光されている。

【0008】発光素子20aから照射された光は、カバー40の集光レンズ部41aにより集光され、前面側に照射される。その照射方向前方に被検出体50が存在する場合は、照射光が被検出体50により反射される。その反射光は、カバー40の集光レンズ部41bにより集光されて受光素子20bに入射し、受光素子20bにより光電変換されて出力される。そして、この出力電気信号により、被検出体50の有無が光学的に非接触検出される。

【0009】このように、集光レンズにより照射光及び反射光の各光束を絞り、検出範囲を制限した反射型光結合装置は、前述したとおり、複写機、プリンタ等の用紙搬送系における用紙の検出に主に使用されている。

【0010】図7はこの用紙検出系の一例を示したものである。この用紙検出系においては、対向配置された水平なガイド板60、70の間に形成された隙間80（通常2～4mm）内を、被検出体50としての用紙が搬送される際に、その用紙が、ガイド板60、70の下方に配置された上述の集光レンズ付き反射型光結合装置により検出される。この用紙検出のために、ガイド板60、70には、抜き孔61、71が、反射型光結合装置の前面側に位置して設けられている。

【0011】このとき、抜き孔61、71の径が大きいと、これらの孔に用紙が引っ掛かりやすくなり、紙づまりの原因となる。このため、抜き孔61、71の径は10mm程度まで制限されている。

【0012】このような状況下で、反射型光結合装置における照射光及び反射光の各光束が大きいと、ガイド板60、70の抜き孔61、71の周囲の部分に光が当たり、不必要な反射光が検出される。その結果、用紙の有無により得られるS/N比の低下が生じ、最悪の場合は、用紙が存在しない状態でも、抜き孔61、71の周囲からの反射光により、誤って用紙が検出されてしまう。

【0013】このため、複写機、プリンタ等の用紙搬送系における用紙の検出には、集光レンズにより照射光及び反射光の各光束を絞り、検出範囲を制限した集光レンズ部付きの反射型光結合装置が使用されているわけである。

【0014】

【発明が解決しようとする課題】しかしながら、従来の集光レンズ付きの反射型光結合装置には、次のような問題がある。

【0015】図7に示されるような用紙検出系にあって

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は、ガイド板60、70の間に形成された隙間80を用紙が通過すること、微量ではあるが、下段のガイド板60の抜き孔61から紙粉が落下する。この紙粉は、下方に配置された反射型光結合装置のカバー40上に堆積し、集光レンズ部41a、41bを覆うことにより、光の出入経路を塞ぐ。このため、メンテナンスサービス等によりカバー40の前面を定期的に拭き取る清掃作業が行われている。

【0016】この清掃作業は、カバー40の前面側の表面が平坦であるほど簡単で確実なものとなるが、従来の反射型光結合装置においては、カバー40に形成された集光レンズ部41a及び41bが、それぞれの前面側の表面42a及び42bが前面側に突出した凸レンズであるため、カバー40の前面側の表面の凹凸が多い。このため、清掃作業の作業性が悪く、しかも清掃状態の確認が容易でないという問題があった。

【0017】本発明は上記従来の問題を解決するものであり、その目的は、集光レンズ付きであるにもかかわらず、そのレンズ部の清掃を容易に且つ確実に行うことができる反射型光結合装置を提供することにある。

【0018】

【課題を解決するための手段】本発明の反射型光結合装置は、遮光部材を挟んで並列配置された発光素子と受光素子とを備え、該発光素子から照射され、被検出体によって反射される反射光を該受光素子によって受光することにより該被検出体の有無を検出する反射型光結合装置において、該発光素子及び該受光素子の前面側にカバーを備え、該カバーの前面側が平面であり、且つ該カバーの後面側の該発光素子及び該受光素子に対向する部分に集光用レンズを設けており、そのことにより上記目的が達成される。

【0019】以下に本発明の作用を説明する。

【0020】本発明の反射型光結合装置においては、発光素子及び受光素子にそれぞれ対応してカバーに形成される各集光レンズ部が、カバーの後面側に突出する状態で形成されているため、カバーの前面側の表面が平坦化され、その表面の凹凸が少なくなる。このため、カバーの前面側の表面を清掃する場合に、その清掃作業が簡単になる。また、その表面が見やすく、表面の清掃状態の確認が容易となる。これらにより、メンテナンス性が向上する。

【0021】なお、集光機能については、各集光レンズ部の前面側の表面を前面側へ突出させた場合と変わらない。

【0022】

【発明の実施の形態】以下に本発明の実施の形態を図面に基いて説明する。

【0023】図1～図3は本発明反射型光結合装置の実施形態を示す。本実施形態の反射型光結合装置は、図1に示されるように、遮光性樹脂からなるボディ10と、

ボディ10内に封入された発光素子20a及び受光素子20bと、これらの前面側に位置してボディ10内に嵌合されたカバー30とを備えている。

【0024】この反射型光結合装置は、図4～図6に示された従来の反射型光結合装置と比較して、カバー30が相違している。以下、カバー30に関係する部分を中心にして、各部の構造を説明する。

【0025】遮光性樹脂からなるボディ10は、平板状のベース部11と、その中央部から上方に突出した凸部12とを有する。凸部12の上面には、カバー30が嵌合する四角形の凹部13が設けられている。凹部13の底面には、凹部13を下方の発光素子20a及び受光素子20bと光学的に連通させるために、開口部14a及び14bが設けられている。また、開口部14a及び14bの間に位置して突起15が設けられている。

【0026】発光素子20a及び受光素子20bは、ボディ10のベース部11の中央部内に封入され、開口部14a及び14bを介して凹部13にそれぞれ臨んでいる。発光素子20a及び受光素子20bの構造は、前述した通り、それぞれの間で共用されるフレーム21の上に発光ダイオード及びフォトダイオードを実装し、各チップを透光性樹脂からなる樹脂体23a及び23b中にそれぞれ封入したのになっている。樹脂体23a及び23bは、その間に充填されたボディ10の形成材料（遮光性樹脂）によって遮光されている。

【0027】カバー30は透光性樹脂を使用した四角形の平板状の一体成形品であり、カバー30の凹部13に上側（前面側）から挿入されている。このカバー30は、図2及び図3に示されるように、ボディ10の突起15が嵌合するスリット34を中央部に有すると共に、スリット34の両側に位置して集光レンズ部31a及び31bを有する。

【0028】集光レンズ部31a及び31bは、発光素子20a及び受光素子20bの各前面側にそれぞれ位置し、それぞれの光軸が前面側で交差する方向に傾斜している。そして、発光素子20a側の集光レンズ部31aは、前面側の表面32aを平面とし、素子側の表面3aを素子側へ球面状に突出させた凸レンズである。集光レンズ部31aの表面32a及び33aは、上述した光軸の傾斜に伴ってスリット34の側へ傾斜している。同様に、受光体20b側の集光レンズ部31bは、正面側の表面32bを平面とし、素子側の表面33bを素子側へ球面状に突出させた凸レンズであり、その表面32b及び33bは、上述した光軸の傾斜に伴ってスリット34の側へ傾斜している。

【0029】また、集光レンズ部31a及び31bは、その間のスリット34にボディ10の突起15が嵌合することによって遮光される。

【0030】このような構成の反射型光結合装置の動作について説明する。

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＊【発明の効果】以上の本発明反射型光結合装置によれば、発光素子及び受光素子にそれぞれ対応してカバーに形成される各集光レンズ部が、カバーの後面側に突出する状態で形成されているため、カバーの前面側の表面が平坦化され、カバーの前面側の表面の凹凸が少なくなるので、カバーの前面側の表面を清掃する場合に、その清掃作業が簡単になる。また、その表面が見やすく、表面の清掃状態の確認が容易となる。従って、集光レンズ付きであるにもかかわらず、優れたメンテナンス性が確保される。

【図面の簡単な説明】

【図２】本発明反射型光結合装置のカバーの平面図。

☒.

【図5】従来の反射型光結合装置のカバーの平面図。

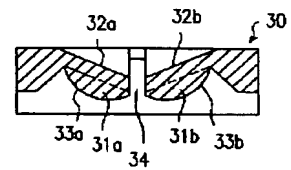
【図 7】反射型光結合装置を使用した用紙検出系の縦断側面図。

10 ボディ

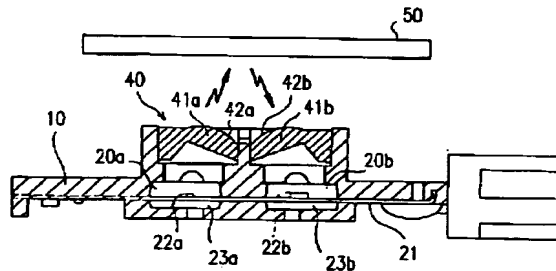
20b 受光素子

31a, 31b 集光レンズ部

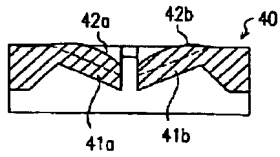
【図3】



【圖5】



【図 6】



【図 7】

